AGRICULTURAL Research

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Beefing Up

Picture the cattle that made the long, dusty drives to western marketing centers of the 1860's: Long legs and horns, small, light bodies. No, they didn't look much like the meaty animals in our mechanized feedlots of the 1960's.

Beef production has come a long way through the efforts of our scientists and cattlemen. Take breeding, for example.

It was in 1893 that the superiority of imported beef cattle breeds over our native types was first scientifically reported. Then, about 1910, USDA and State agricultural experiment station people started a better-sires campaign.

From these beginnings, research expanded its studies of breeding and performance testing. Since about 1946, we have been testing and using the heritability of economic traits—birth weight, feedlot efficiency, carcass grades. Findings have varied greatly, but scientists agree that these traits are highly heritable. As a result, performance testing plans have been set up across the country to keep records and select the most efficient animals to improve herds.

ARS is continuing its long-term research on breeding and performance testing through three regional projects with the cooperation of 35 State experiment stations and 6 Federal field stations. What we're trying to do is to develop meat animals with the best combination of carcass quality, growth and feed efficiency, mothering ability, and longevity.

We are putting more emphasis on finding ways to measure the quality factors that consumers want: More well-marbled lean meat without excess outside fat, along with flavor, tenderness, and general appeal. These characteristics are inherited, too—but not necessarily with any relationship to other economic traits. We need a lot more answers to establish definite knowledge on which to base practical breeding efforts.

Scientists and cattlemen will continue to work together to find answers to the questions we face in breeding, feeding, management, and disease control, as well as in keeping and expanding markets. Their efforts will benefit not only the folks who raise cattle but also the many people throughout the country who want plenty of beef in their diet.

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for Outstanding Service

H.L.J. Haller

E.F. Knipling

Leadership, performance, and teamwork are given emphasis in selection of award winners in annual USDA recognition

■ Each year USDA selects for special recognition those employees who have made significant contributions through research or administrative achievements. On May 17, 1960, Secretary Ezra Taft Benson awarded medals for distinguished service to seven individuals and to one work unit. Medals for superior service also went to 82 persons and 12 work units. In addition, 63 persons were honored for 40 years' service.

ARS winners of Distinguished Service Awards:

H. L. J. HALLER, *Office of the Administrator*, for national and world leadership in research on agricultural chemicals and for making contributions to chemical control of agricultural pests.

E. F. KNIPLING, *Entomology Research Division*, for stimulating research, conceiving new approaches to insect control, and contributing to control of livestock insects and vectors of human disease.

ARS winners of Superior Service Awards:

Animal Disease Eradication Division: F. J. MULHERN, for directing a nationwide cooperative program to eradicate vesicular exanthema in swine.

Animal Husbandry Research Division: N. R. ELLIS, for leadership and contributions to development of more effective methods of breeding, feeding, and managing livestock and poultry.

Crops Research Division: P. BRIERLEY, for significant advances that add to scientific knowledge of virus diseases of ornamental plants.

L. E. COMPTON, for organizing work of many cooperators in a breeding program that has resulted in developing 13 improved varieties of small grains.

REGIONAL SMUT RESEARCH LABORATORY, for developing, through basic and applied research, practical measures to control bunt, a major disease of wheat, thereby improving wheat production and market quality of grain.

G. F. SPRAGUE, for original research in corn genetics and breeding, and leadership of a comprehensive corn improvement program that gained worldwide recognition.

V. G. SPRAGUE, for developing plant-growth chambers for studying physiological-environmental interactions of forage crops, and contributions to science of plant physiology, microclimate, and pasture management.

Eastern Utilization Research and Development Division: C. O. WILLITS, for contributions to maple sirup produc-

FOR OUTSTANDING SERVICE

(Continued)

tion, resulting in higher quality products and increased farm incomes.

Farm Economics Research Division: C. W. Crickman, for imaginative approaches to economic research, in cooperation with States, on profitable adjustment in farming to meet changing conditions.

Meat Inspection Division and Animal Disease Eradication Division: Radiological Defense Training Team, for training USDA key personnel in radiological defense, involving long, intensive study of radioactivity and presenting facts effectively.

Northern Utilization Research and Development Division: T. G. Pridham, for contributions to identification and classification of the Actinomycete group of microorganisms and development of a new antibiotic.

Plant Pest Control Division: C. C. Fancher, for administering the many cooperative Federal-State plant pest regulatory, control, and eradication programs in the Southeastern United States.

Soil and Water Conservation Research Division: F. E. Allison, for improving ways of using nitrogen fertilizers, legume inoculants, and crop residues on farms.

Southern Utilization Research and Development Division: Flame Resistant Cotton Research Group, for discovering an important new class of phosphorus-containing polymers and using them in processes to impart durable flame resistance to cotton fabrics.

State Experiment Stations Division: W. P. Meyer, for developing coordinated and cooperative communications programs at State agricultural experiment stations, resulting in effective dissemination, acceptance, and application of research results. ☆

High Award to Research Entomologists

The Hoblitzelle National Award in the agricultural sciences was given this year to E. F. Knipling, Director of Entomological Research in USDA's Agricultural Research Service, and R. C. Bushland, in charge of the Kerrville, Tex., Livestock Parasite Laboratory. They were honored for their significant and highly successful research that has eliminated the screwworm from the Southeastern States.

The fifth presentation of the $10,000 award was made on May 18 at the Texas Research Foundation at Renner, Tex. Awarded biennially, it is given to the person or persons who made the most important scientific contribution to American agriculture in the preceding 4-year period.

Research started in 1946

Knipling in the 1930's conceived the idea that screwworms could be eradicated by sterilizing laboratory-reared males and dispersing them in large numbers to mate with native females. However, the research necessary to carry out the idea was not started until 1946 when Knipling directed researchers at the Kerrville laboratory to investigate the mating habits of screwworms and to find chemical agents that would cause sexual sterility. Later, radiation was used to induce sterility.

There were other problems, too. Large numbers of flies were required, the radiation dosage to make males sterile without interfering with their normal mating had to be determined, and distribution of the irradiated flies had to be worked out.

Bushland, as early as 1936, had produced screwworms in an artificial medium and this method was used as a basis for mass rearing the flies needed. He studied use of radioisotopes and nuclear energy at Oak Ridge and worked with specialists to adapt radiation techniques to obtain effective sterilization of the screwworm.

With the technique developed (Agr. Res., July 1958, p. 8), screwworms were successfully eradicated from Curacao in 1954 and later from the Southeastern States. In the latter cooperative State-Federal program, some 2¾ billion flies were released from 20 planes over 85,000 square miles in a little over a year's time. Elimination of the screwworm will prevent losses up to $20 million yearly to Southeastern cattlemen. Screwworms cause severe damage and death of livestock and wildlife if not treated.

New ideas were stimulated

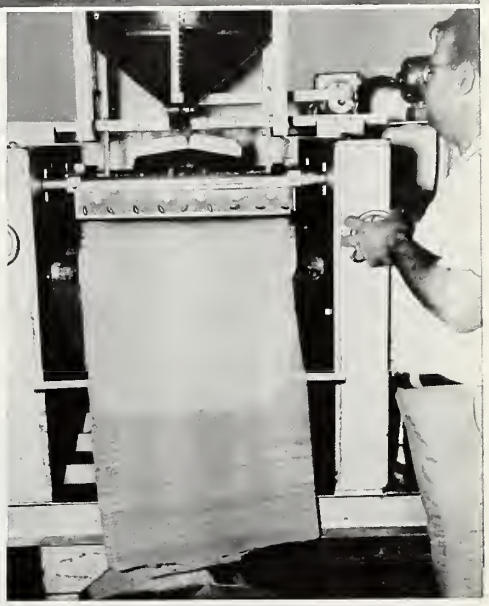
The success of the sterile-male techniques has made a strong impact on scientific thinking and is stimulating new ideas on insect control. The method is being adapted and will be tested on isolated Pacific islands to determine its feasibility for eradicating fruit flies (Agr. Res., March 1960, p. 8). Further research may show that the method is practical for other destructive insects.

The Hoblitzelle Award was established in 1950 to stimulate basic scientific research and to encourage scientists to direct their efforts toward solving the Nation's major agricultural problems. USDA plant geneticist E. R. Sears received the award in 1958 for transfer of leaf-rust resistance to wheat. ☆

Bulk and weight of whole sweetpotatoes are greatly reduced by processing.

We'll try Commercial Production of . . .

INSTANT SWEETPOTATOES



This sheet of instant sweetpotatoes, coming out of the dryer, is now ready to be broken into flakes.

■ Commercial production of instant sweetpotatoes may result from research conducted by USDA Southern utilization division scientists.

Flakes that produce instant sweetpotatoes with the color and flavor of fresh pureed sweetpotatoes have already been prepared in the laboratory at New Orleans. When added to hot water or milk, the product is ready in 60 seconds to serve or to use in a pie or casserole.

The method used is similar to that developed by Eastern utilization division scientists for making instant white potatoes. (See AGR. RES., February 1955. p. 12; January 1957, p. 7; and November 1958, p. 16.)

Pilot plant starting in fall

New pilot-plant equipment, financed from funds made available this year by Congress, will be used in developing processes to make commercial production feasible. ARS scientists must also find a means of insuring flavor stabilization during storage.

Plans are to begin operation of the pilot-plant facilities next fall after the sweetpotato harvest and make flakes for consumer testing, probably late this year or early 1961.

Oxidation appears to be the principal cause of flavor change in the flakes, scientists report, and packaging in nitrogen or a similar gas may ensure flavor stabilization. Samples of flakes packaged in nitrogen, as some coffee is packaged, retained full flavor more than a year. Flakes packaged in ordinary atmosphere deteriorated in a few weeks.

During the processing. sweetpotatoes are washed, preheated in warm water, peeled, trimmed, cut into pieces, and cooked. Then they are made into a puree and dried in thin sheets. As these sheets come from the dryer, they may be broken up and packaged as flakes. The flakes may be ground so a maximum amount can be placed in each container, but this advantage may not justify the cost. Grinding doesn't change flavor or texture.

Crop could regain position

Commercial development and marketing of instant sweetpotatoes could help restore this crop to its former place in agriculture. Production in 1957, for example, was only about 36 million bushels—compared with about 75 million bushels in 1944.

Instant products will probably be made from oversized and malformed sweetpotatoes. These account for 30 to 50 percent of annual yields and are always difficult to market because of their size and shape. But in food value and flavor, they are equal to No. 1 sweetpotatoes. ☆

BREEDING FOR RUST-RESISTANT OATS

Most serious disease of oats may be controlled because of resistance found in wild plant

■ Superior disease resistance in a type of wild oat and a lucky break in genetics have increased the prospect of oat varieties resistant to all known races of crown rust.

Efforts to find complete resistance were intensified in 1957 when races of crown rust, rare or previously unknown in this country, first became a serious threat to U.S. oat production. One or more of these rare races attack all varieties of cultivated oats now grown.

Breeding new varieties resistant to the more than 100 races of crown rust has been the only practical means of preventing disastrous losses to growers. Crown rust is the most serious disease of oats grown in major producing areas of the world.

Source of the needed crown rust resistance is Saia, a wild oat resistant to the new rust races from seedling stage through maturity. Saia is native to Western Europe and is not found naturally in the United States.

Lifelong protection is given

Varying degrees of adult or field resistance to the new rusts have been found in other oat varieties, but Saia offers lifelong resistance to the new crown rusts and to all prevalent races of stem rust and smut.

Experiments to transfer Saia's resistance to commercial breeding stock were conducted by USDA plant cytogeneticist K. Sadanaga and pathologist M. D. Simons, cooperating with Iowa Agricultural Experiment Station.

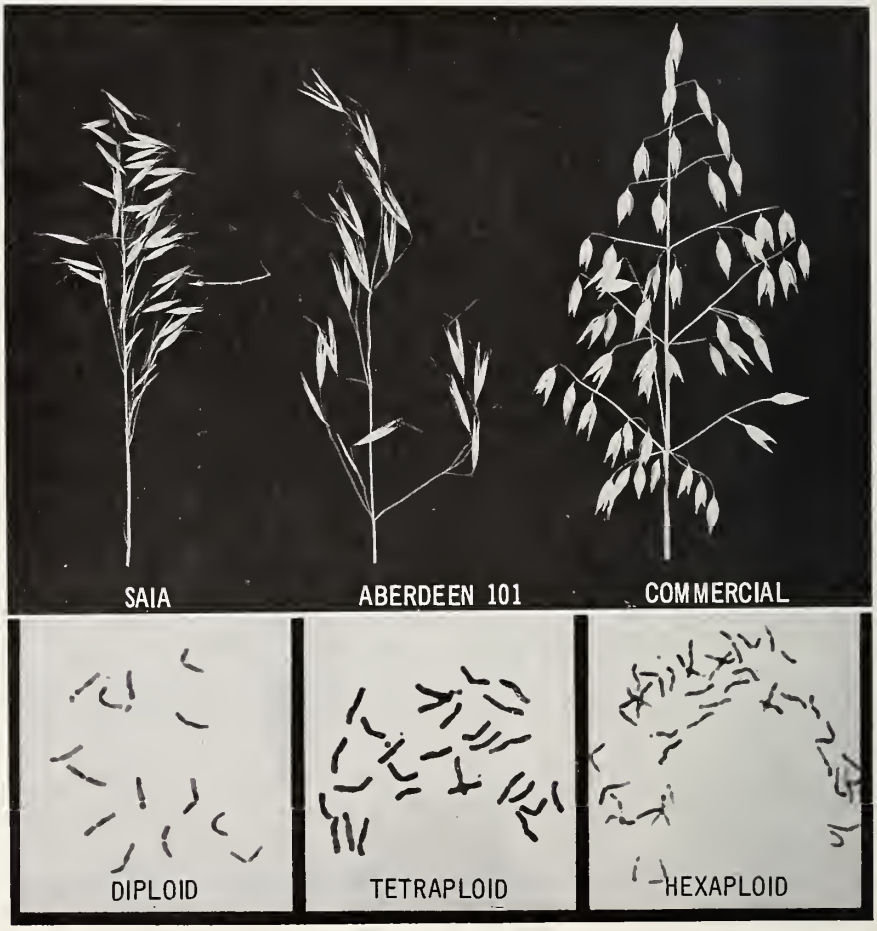
Saia is a diploid oat possessing 14 chromosomes (2 sets of 7). Cultivated oat varieties are hexaploids having 42 chromosomes (6 sets of 7). Chromosomes are the small bodies that carry the genetic factors and are found in the nucleus of each cell. Because of the wide difference in chromosome count, diploid and hexaploid oats cannot be crossed directly.

To accomplish the transfer of resistance, the ARS scientists used an intermediary oat—Aberdeen 101—a tetraploid oat with 28 chromosomes (4 sets of 7). Hybrid plants can be obtained in crosses between diploid and tetraploid oats and between tetraploid and hexaploid oats. The percentage of successful crosses is much lower, however, than in crosses between or within plants having the same number of chromosomes.

First cross made in 1952

Aberdeen 101, the genetic lucky break, resulted from a cross made in 1952 by F. J. Zillinsky, then a graduate student at Iowa State University, between the diploid Saia and a tetraploid oat. This cross was made only to test the possibility of crossing oats with different chromosome counts.

In the third generation of this cross growing at Aberdeen, Idaho, a fortuitous trick of nature appeared. H. C. Murphy, national leader of oat investi-



gations for USDA, then stationed at Ames, found one fully fertile plant whose progeny bore genetic characteristics of the tetraploid parent in addition to Saia's gene for resistance. The chance of finding resistance plus full fertility in the third generation was so remote that it was thought almost impossible.

When the rare crown rusts broke out in 1957 and Saia's resistance to them was discovered, Aberdeen 101 was immediately available for the second stage of the breeding program.

In this stage, scientists attempted to cross Aberdeen 101 with cultivated oats. Only a few seeds were obtained in the original crosses from the hundreds of artificial pollinations made. These seeds germinated and produced vigorous plants that had Saia's resistance but were, as expected, almost self-sterile—incapable of producing seeds with their own pollen, as normal oats do.

Sadanaga and Simons found that a few seeds could be produced by backcrossing with pollen from cultivated oats. Plants that grew from these first-generation seeds, fertilized by backcrossing, appeared to be normal and produced some seeds—indicating that self-fertility improves with each generation of backcrossing to the cultivated oat parents.

Commercial oats are used

Cultivated oats used in backcrossing included improved Clintland 60 and several other new disease-resistant types that already bear resistance to all known races of crown rust and stem rust, other than the rare races, and to smut and other diseases.

Seed of the fifth-generation progeny of these backcrosses displays the good characteristics of their cultivated parents, in addition to Saia's desirable resistance. Seed is available to plant breeders for increase and for further crossing but none will be distributed by USDA. ☆

We can get more out of

Nitrogen

Many tons of nitrogen fertilizer will be left in our soils next fall after harvest. Can we cut winter nitrogen loss? Can we estimate what's left next spring when making fertilizer recommendations?

These are questions USDA and State scientists are trying to answer. The answers are important because we spend over a third of a billion dollars a year for nitrogen fertilizer in humid regions of the country—and only about half of that amount is taken up by crops.

So far, little consideration has been given to carried-over nitrogen when making fertilizer recommendations. And no extensive effort has been made to follow practices that will help save these millions of dollars worth of nitrogen. With more and more nitrogen being used, losses are proving extremely costly. However, few dependable answers have been found. This is what we have learned:

—There *are* important annual carryovers of nitrogen fertilizer.

—The residual effect *varies* from year to year, but does not appear to be related to total rainfall.

—Fall-applied nitrogen is only about 57 percent as effective as spring-applied nitrogen for corn in humid areas.

These facts are part of the results of 5 years' cooperative research by ARS and the Alabama, Mississippi, and Georgia Agricultural Experiment Stations. Related studies are also being conducted by other States and nations as the extent of nitrogen loss is discovered.

From these many sources there is accumulating evidence that scientists have *not* been correct in believing that the bulk of nitrogen loss occurs only through leaching. Evidence now shows that nitrogen, regardless of its form, is also lost to the atmosphere—through volatilization of molecular and nitrous oxides in appreciable quantities. There is no agreement yet as to how important volatilization losses are in the field or how farmers can prevent them.

Many factors govern the amount of nitrogen recovered

These new facts combined with what is already known indicate that fertilized crops recover a variable fraction of the applied nitrogen—depending on rate used, rate of plant growth, rainfall distribution and amount, competition by other plants and microflora, ammonium fixation, and probably other factors.

So we begin with an unknown quantity of nitrogen left after harvesting the first crop. How much remains in the plant root zone in forms that are, or can become, available to the next crop will be influenced by soil temperature and moisture, soil physical properties and reaction, type of microflora, and rainfall distribution and amount.

When the complete answer to the nitrogen story is found, we may be able to save fertilizer by decreasing the amount lost during the winter and by determining what amount is left in the spring. ☆

After studying needs, researchers have come up with practical, attractively designed

Clothes for Handicapped Homemakers

■ We have an estimated 10 million physically handicapped homemakers in this country. These women need, and want, clothes suited to their disabilities and their ways of doing things so they may work efficiently and care for themselves.

To help in meeting these women's needs, clothing specialists in USDA's Institute of Home Economics developed a variety of garments of the types commonly used for housework—dresses, blouses, skirts, shorts, slacks, pedal pushers, a jacket, and aprons. Wheelchair pockets were also included. The special features in these garments will be helpful to the handicapped and to the able as well.

Disabled women aid in study

The garments were developed according to information given by 70 cooperating homemakers—most of whom were disabled by infantile paralysis, multiple sclerosis, or arthritis, and used a wheelchair, crutches, or braces. All of the women stressed the need for garments easy to put on and take off and to fasten and unfasten without help from others.

Since many who are handicapped must sit while working, they need clothes that will let them reach up, forward, and down with minimum restraint. Clothes that bind are fatiguing—and wear out quickly.

Still another need of the handicapped is for safe clothing that stays out of the wearer's way and is neither too tight nor too loose. A fall or other accident may prove more serious to such a person than to an able one and increase her disability.

Garments meet requirements

Garments developed by the specialists meet these requirements by incorporating such features as—

. . . Front openings easy to see and reach when dressing. But skirts that wrap around in the back are included for convenience of wheelchair users who have able arms and hands.

. . . Fasteners that are suitable for stiff or unsteady fingers.

. . . Beltless waistlines or attached belts that can't be misplaced.

. . . Open necklines and short sleeves for coolness and convenience. When collars are used, they are low-rolling, do not ride up as shoulders move.

. . . Three-quarter sleeves, when needed for warmth, shaped so they allow bending and don't catch on things.

. . . "Give" features using shaped insets, bias cut, or special elasticized and stretch fabrics at places subject to strain.

. . . Easy fit, especially around the waist, abdomen, and hips to allow the garment to adjust to the figure, look well, and allow comfortable sitting for prolonged periods.

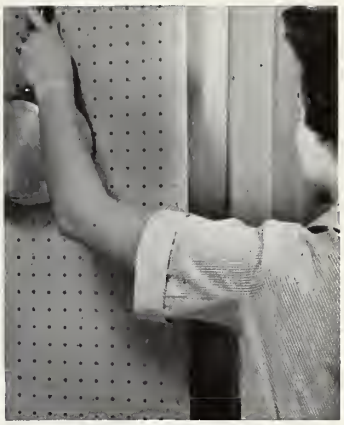
. . . Moderately full skirts—2 to 2½ yards wide—to allow a natural unhampered stride and not hinder the wearer in regaining balance when threatened with a fall. Such skirts help conceal braces. They do not puff in the lap or need to be pulled down as slim styles do when the wearer is sitting or being carried. And they are not so wide as to be bothersome; full skirts drag on the floor when the wearer is sitting, interfere with chair wheels, and catch under crutches or canes. Also, wide skirts are more laborious to launder.

. . . Slacks with a long back rise and short front, contributing to comfort during prolonged sitting. This cut causes less lap puff and relieves much of the usual crotch-to-knee strain.

. . . Pockets, important for holding articles when hands are occupied.

Bias pleat inserted in seam opens with movement, closes with arm down.

Extending blouse into sleeve gives strength and room for action.



Frcedom of action without strain is also featured here.

For long reaches, dress has elasticized back, insert at waist that opens, raglan sleeve designed for "give." Skirt fits easy for comfort.

Flat, firm, waterproof apron shaped to fit lap has corded rim to keep things from sliding off.

ith crutches or a chair. In the new arments, pockets are large and rong, reinforced against strain, and ıt higher at the back so articles do ot slide out while the wearer is sitng. Placed at the side, pockets do ot get in the wearer's way when she oes work on her lap. For homeıakers who use a wheelchair, there re pockets fitted to the chair arm for rganizing and keeping at hand artiles needed during the day. Such ockets take the burden off clothes.

ommercial use is suggested

Project leader Clarice L. Scott oints out that principles behind these esigns can be applied in many ways. Ianufacturers may use them in comıercial garments just as children's nowsuits and women's work clothes ere made from designs developed ears ago by USDA clothing specialsts. ☆

Sectional pockets on chair arm keep needed articles at hand, also hold materials used in pickup and cleanup.

This apron safely holds articles and foods while protecting clothes—leaving hands free to operate wheelchair.

NEW SHEEP FOR THE SOUTHWEST

Hardy new strain, typified by lamb, produced the wool for handwoven Navajo rugs in background.

■ New strains of sheep—hardy enough to withstand the rigorous environment of southwestern ranges, able to produce good feeder lambs and grow good-quality fleece for handweaving—have been developed by USDA.

These strains came out of a continuing sheep-breeding study conducted by the New Mexico Agricultural Experiment Station at Fort Wingate, the Bureau of Indian Affairs of the U.S. Department of Interior, and ARS.

During 20 years of breeding and selecting, fleece weights were doubled, wool quality was improved, and objectionable hollow and brittle fibers—often 70 percent of the original fleece—were eliminated.

Foundation flock for this work consisted of about 800 Navajo ewes and about 20 Navago rams. These sheep were selected because of their hardiness and adaptability to southwestern ranges, qualities that were largely retained in the new strains. Foundation stock produced small quantities of carpet-type wool and inferior lambs, but breeding improved these two characteristics.

Through crossbreeding with improved rams, two new strains were developed. One strain produces coarse wool, used by Navajos in handweaving operations. The other is a type used for commercial wool production.

Results of other breeding experiments at the Fort Wingate station demonstrate the effectiveness of consistent breeding and selection for improving wool production. Offspring of highly selected Targhee, Rambouillet, and other improved breeds had longer staple and heavier yields of clean wool than the young of control sires mated to average Navajo ewes. ☆

HOW ANTIOXIDANTS PREVENT A MINK DISEASE

■ The usefulness of several antioxidants for preventing yellow fat or steatitis—a costly disease common in mink that are fed fish-cannery wastes—was demonstrated in long-range State-USDA studies.

Where available, fish-cannery wastes are often fed as a major part of mink diets. But prolonged feeding of these wastes, without the protection of some compound to stabilize the fat, can result in steatitis.

The use of antioxidants for this purpose isn't new, of course. But their experimental use over 5 years adds valuable information on reproduction and possible toxic effects. Results of these tests are also adding to our knowledge of the special difficulties involved in feeding fish to fur animals and are helping us to understand how antioxidants act to stabilize fat in animal feeds.

The feeding trials were conducted at the Experimental Fur Station, Petersburg, Alaska, in cooperation with the Alaska Experiment Stations and the University of Alaska.

Synthetic antioxidants tested were diphenyl-para-phenylenediamine (DPPD) and butylated hydroxytoluene (BHT). The effects of tocopherol (vitamin E with antioxidant properties) and chlortetracycline (an antibiotic) were also studied. All diets contained at least 50 percent salmon wastes—chum, red, or pink salmon—dry cereal mix, and vitamin E in the form of wheat germ meal and oil.

Steatitis was most effectively prevented by BHT—112 grams (about 4

ounces) per ton of wet feed. BHT had no effects on production of weaned kits (young minks), and average weaning weights were greater than those in other groups in some tests. There seemed to be no toxic effects due to BHT feeding, according to J. R. Leekley, fur station director.

Steatitis didn't occur in any of the kits on chum salmon diets, either with or without BHT.

DPPD also proved effective in reducing incidence of steatitis. But data on kit production showed a reduction in number of weaned kits.

BHT, DPPD most effective

Both BHT and DPPD were more effective in preventing steatitis than tocopherol or the antibiotic at the levels used. There were some deaths in kits fed the antibiotic and tocopherol without either BHT or DPPD.

The incidence of steatitis was high, ranging up to 69 percent, among kits fed diets of red and pink salmon but *not* receiving any protection from the experimental supplements.

This disease can cause high losses in mink herds. It often occurs on commercial fur farms, especially where stored frozen fish and fish wastes are fed as a major part of the diet. And since fish products are commonly fed now, replacing the diminishing supply of horsemeat, the incidence of steatitis is also increasing. Horsemeat and other fat-containing ingredients are not always safe. They can cause steatitis, too, if the fat has oxidized enough.

Fish wastes may contain relatively large amounts of unsaturated fatty acids that decompose and form compounds that destroy available vitamin E. The sick animals either stop eating or eat less, their fat turns a yellowish color, possibly due to some enzymatic action, and they waste away and die. Adding vitamin E to the diet helps reduce the incidence of steatitis. Savings are possible by using an antioxidant, such as BHT, to prevent decomposition of the vitamin E.

Spoilage kept to a minimum

In preparing the diets, the frozen fish wastes were thawed, ground, and mixed with the other ration ingredients just before feeding to keep spoilage to a minimum. About a week's supply of the dry feed ingredients (including the antioxidant) were mixed and stored in a metal container.

The feeding trials all began early in the year about a month before the breeding season. The animals were fed during the breeding, gestation, and suckling periods. Half the producing females and their kits were kept on the test diets until pelting the following December. ☆

COOKED GARBAGE IS GOOD HOG FEED

■ Cooked garbage for feeding swine varies greatly in chemical composition. But on a dry-matter basis, garbage is much the same in nutritive value as conventional feeds—cereal grains and oil meals—and is high in the minerals necessary for young pigs.

Moreover, the nutritive value of raw garbage isn't much changed by cooking, State-USDA studies indicate. Cooking is necessary and prescribed by most States to control the spread of vesicular exanthema, a dangerous swine disease that spreads rapidly if unchecked.

Cooked garbage differs from conventional swine feeds mostly in its low dry matter and high crude fat content. The composition depends largely on the source, and to a lesser degree, on the season, month, and day collected. For instance, institutional garbage contains much less of the extraneous items (mostly paper products) found in household garbage. Household garbage is high in fiber and ash and in calcium.

Apparently, our seasonal eating habits are reflected in the quality of the garbage we accumulate. Samples highest in protein were found in the spring months on Mondays and Tuesdays. Garbage on these 2 days was derived from food used on weekends.

Other seasonal effects—although *not* significant—were noticeable. They included low protein in fall and summer garbage, high ash in summer, high calcium and phosphorus in spring, low phosphorus in fall, and low pH of spring and summer garbage. The bulky, light, picnic-type foods eaten in summer may explain in part the higher ash, calcium, and phosphorus. High calcium in warm months may also reflect the lime commonly used in garbage pails to keep flies away. Scientists aren't sure why the other mineral differences show up the way they do.

Supplementing garbage increased daily gains

Weanling pigs fed various levels of high-quality garbage did quite well; those on garbage alone gained up to 1.5 pounds daily over a 66-day feeding period. Supplementary feeding with a conventional dry meal produced somewhat larger gains than garbage alone. (However, additional feed wouldn't be necessary where high-quality garbage was available.) Garbage feeding had no effect on carcass characteristics.

Eight swine feeding installations in Virginia were included in the study, conducted cooperatively by Virginia Agricultural Experiment Station and ARS. ☆

Soybeans are being bred to resist:

SOYBEAN CYST NEMATODE

■ Soybean varieties resistant to the soybean cyst nematode, a pest that stunts plant growth and can cause total crop failure, are expected to be ready for growers with infested land in about 4 years.

Work is underway by USDA and State agricultural experiment stations to incorporate resistance into five established varieties adapted to production in different parts of the infested area. Development of Lee and Hill is the most advanced. The nematode is now known to occur in North Carolina, Tennessee, Missouri, Mississippi, Virginia, Arkansas, Kentucky, and Illinois.

The discovery of resistant selections by ARS plant pathologist J. P. Ross and agronomist C. A. Brim, in cooperation with the Raleigh, N.C., station (AGR. RES., Feb. 1958, p. 15), was the beginning of this complex work. Next came the important step of finding out how resistance is inherited, to set a pattern for breeding.

Three recessive genes control resistance

A study by B. E. Caldwell (now at Iowa State University), Brim and Ross established that resistance is probably controlled by three separate genes, all recessive. Control of resistance by a recessive gene means that in the F_2 generation of a cross between a resistant and a susceptible variety, one out of four plants would be expected to be resistant. With control by 3 independently inherited recessive genes, only 1 out of 64 plants in the F_2 generation would be expected to be resistant.

Brim and Ross are working with the variety Lee, which is adapted to North Carolina, Virginia, Mississippi, Arkansas, and other States. The second backcross has been completed; the third will be initiated this summer.

At least four backcrosses must be made to incorporate resistance into a commercial variety. Because inheritance of nematode resistance is controlled by recessive genes, three generations of plants must be grown to complete one backcross. Brim and Ross have worked out a schedule so the three generations can be grown in 1 year.

Commercial soybeans are used in backcrossing

The generation to be tested for nematode reaction is grown in the greenhouse. Plants found to be resistant to the nematodes are used in the next backcross to the commercial variety. Seeds obtained from this cross are grown in the greenhouse and the plants are allowed to self-fertilize. The seeds from the selfed plants begin the cycle again—this is the generation that contains the approximate 1 resistant plant out of 64.

Breeding is also underway at Stoneville, Miss., where ARS agronomist E. E. Hartwig has obtained a second backcross with Hill, a variety adapted to Tennessee, Kentucky, and Mississippi. At Columbia, Mo., ARS agronomist L. F. Williams is working with varieties Clark, Scott, and Harosoy, adapted to Missouri and Illinois. Facilities for testing for nematode resistance aren't available at either of these stations, so this step in the cycle is carried out by ARS nematologist J. M. Epps at Jackson, Tenn. This arrangement—with some traveling back and forth by Hartwig and Williams—permits one backcross to be completed each year, as in North Carolina. ☆

Cross is made by applying pollen from male parent to flower which has had its own pollen removed.

Plants A, D are resistant to nematode. Plants B, C show stunting and yellow leaves typical of susceptible reaction.

Roots are from plants susceptible (left) and resistant to nematode.

...ROOT AND STEM ROT

■ Resistance to *Phytophthora* root and stem rot, a fungus disease of soybeans. is being incorporated into susceptible soybean varieties grown commercially in several areas where the disease is a serious problem.

This disease attacks soybeans grown in poorly drained, compact soils or in soils on which excessive flood irrigation is used. Since 1951, when it was first identified in the United States, the disease has caused extensive losses in the heavy soil areas of Ohio and Ontario, and sporadic damage in Indiana, Illinois, North Carolina, Missouri, and Mississippi.

The disease attacks soybeans at all stages of growth, causing internal browning and discoloration of the root and lower stem, softening of cell structure and, in most cases, death of the plant. In laboratory tests, death has resulted in 2 to 4 days from infection.

Resistance has been transferred into several previously susceptible varieties by State-USDA scientists at the U.S. Regional Soybean Laboratory, Urbana, Ill. These varieties are adapted for the North Central United States, where 80 percent of the annual soybean crop is grown.

Blackhawk is used as source of resistance

Breeding for resistance in varieties adapted to this and other regions is also conducted cooperatively or by the State in Missouri, Indiana, Ohio, and Mississippi.

Source of resistance used is Blackhawk, a variety grown in the North Central United States. The susceptible varieties to which Blackhawk's resistance is being transferred are grown in areas of this region where the disease is a problem and where Blackhawk cannot be grown successfully because of its date of maturity.

Resistance is also found in several older soybean varieties but Blackhawk's improved characteristics make it more desirable for use in crossbreeding.

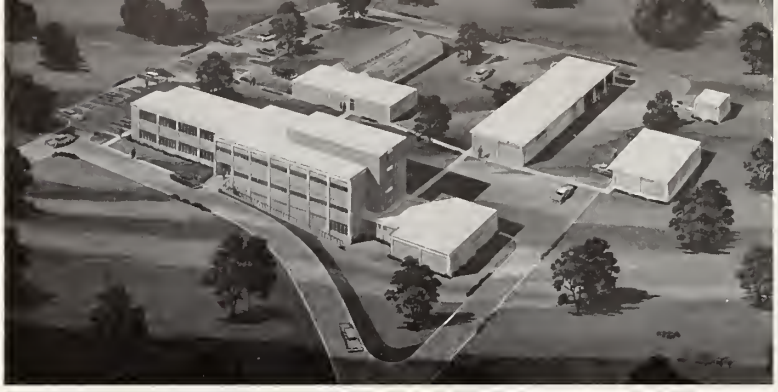
Backcrossing removes other characteristics

ARS agronomist R. L. Bernard crossed Blackhawk with susceptible varieties and then backcrossed the progeny that had picked up Blackhawk's resistance with the susceptible parent. The resistance was transferred, but other characteristics of Blackhawk were bred out. The resulting plants, except for resistance, are practically identical to the recurrent parents.

Seed for some of the newly resistant varieties is being increased this summer and will be used in regional performance tests. Other varieties, less advanced in the backcrossing program, are being improved through further laboratory work. No seed of any of the new resistant varieties will be distributed by USDA. ☆

Hawkeye soybean (right), bearing Blackhawk gene for resistance to root and stem rot, shows no symptoms of the fungus 4 days after inoculation. Other Hawkeye, minus gene, was dead in 4 days.

Phytophthora root and stem rot mycelium is inserted through slit in stem of 10-day-old soybean plant (left). After inoculation, the open wound is sealed (right) with a covering of petroleum jelly.



Facilities for radiation studies are included in the Boll Weevil Laboratory at State College, Miss.

Northern Grain Insects Research Laboratory will have office-lab, greenhouse, at Brookings, S. Dak.

Southern Grain Insects Research Laboratory will consist of five structures at Tifton, Ga.

Three main buildings will house facilities of the Crops Research Laboratory at Logan, Utah.

Improved facilities for insect, crop research

NEW LABS GO UP

■ Four new laboratories are being constructed for USDA research. Three will be used for expanded studies on control of cotton and grain insects: the fourth will provide modern facilities for crops research.

Architects' designs for the ARS laboratories were recently approved by the General Services Administration. The entomology laboratories were recommended by various study groups in response to congressional requests that USDA appraise research and facility needs primarily for increased efforts to control the costly boll weevil and corn insects.

State College, Miss., is the site of the $1,100,000 laboratory where a team of research entomologists, chemists, plant breeders, an agricultural engineer, and a farm economist will concentrate studies on new approaches to control of the boll weevil and other cotton pests. Much of the work will be basic research.

Scientists at the Brookings, S. Dak., and Tifton, Ga., laboratories will engage in an all-out effort to develop more effective control methods for the corn borer, corn earworm, fall armyworm, rice weevil, and other insects attacking grain. The laboratories will each cost $550,000.

New facilities at Logan, Utah, will furnish space for the transfer from Salt Lake City of research on sugarbeet breeding, quality, production, and diseases, as well as nematode control in sugarbeets, fruits, and forage crops. The $600,000 laboratory will also provide room to accommodate present experimental work at Logan on alfalfa, grass, range reseeding, legume-seed production, and safflower. ☆

$72 million lost to borers

European corn borers last year destroyed nearly 68 million bushels (valued at almost $72 million) of corn grown for grain.

This loss, amounting to 1.7 percent of the total crop, is based upon estimates compiled by USDA and State workers in 18 States in which the major part of the corn crop is produced each year. The total quantity lost is the smallest since 1952.

More than 16 million bushels were lost in Nebraska, 15 million in Iowa, and 10 million in Illinois. Losses totaled more than 6 million bushels in Indiana, 4 million in Minnesota, and 3 million in Ohio.

Estimates are based on borer population surveys conducted by State entomological workers last fall.

Retarding forest fires

Swelling-type bentonite clay is a good forest fire retardant, according to USDA's Forest Service, because the material absorbs and retains much water for 2 to 3 hours—even in dry summer weather.

After being dropped by air tanker, the clay coats plant growth and prevents burning. Bentonite spread over a wide area can retard wildfire.

Effectiveness of the swelling clay was compared to that of sodium calcium borate, often used to retard forest fires, by foresters C. B. Phillips, California Division of Forestry, and H. R. Miller, Jr., U.S. Forest Service. They were located at the Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif., at the time of the study.

These researchers cite bentonite because of its relatively low cost, nonabrasiveness to metal, nontoxic and noncorrosive qualities, comparatively light weight per gallon of slurry, and general availability.

Two disadvantages of bentonite, compared to sodium calcium borate, are effectiveness for a shorter time and the need for added color to aid in determining where the clay has been dropped.

Bentonite also has certain mixing, storing, and transportation characteristics that should be understood before it is used.

Sun causes decomposition

Diuron and monuron, widely used herbicides, can lose effectiveness after prolonged exposure to ultraviolet light from the sun, resulting in poor weed control in areas of much sunshine and little rainfall.

This may partially explain why herbicides sometimes are not effective in arid areas, according to USDA agronomists L. W. Weldon and F. L. Timmons. They say both weed killers may decompose before being carried into the soil by rainfall or irrigation.

Industry researchers report that monuron loses 83 percent of its effectiveness after 148 days of exposure to sunshine. Each chemical lost 75 percent of its effectiveness after exposure to ultraviolet light for 28 hours (about 8 to 12 days of full sunshine) in laboratory tests by Weldon and Timmons. However, extensive field research is necessary before definite daily equivalents can be determined. The ARS scientists worked in cooperation with the Wyoming Agricultural Experiment Station.

Decomposition of the chemicals seemed to increase gradually with an increase in illumination intensity, and diuron tended to break down faster than monuron. Although artificial illumination used in the laboratory experiments was similar to sunlight, it included wavelengths of ultraviolet radiation that do not reach earth.

They keep a year in freezer

Well-packaged, ready-to-cook frozen ducklings and geese—despite their high fat content—can be stored safely up to a year at 0° F. or below, according to USDA studies. In quality retention they are comparable with well-packaged turkeys and chickens, investigated earlier.

About two-thirds the commercial production of ducks and a large proportion of geese are marketed as frozen, ready-to-cook products.

Food technologists A. A. Klose, Agnes Campbell, and Helen L. Hanson of the ARS Western utilization division, Albany, Calif., conducted frozen storage tests on commercial packs of ready-to-cook ducklings and geese at temperatures ranging from −30° F. to 20° F. Evaluations were made of moisture loss, rancidity development, and off-flavors and off-odors in thawed and cooked meat.

In general, results showed that both

products have a commercial life of 9 to 12 months when stored at 0° F. or below. The first noticeable flavor changes were in the cooked skin. In chickens, on the other hand, off-odors in the raw meat are the first noticeable signs of flavor changes. This difference may be attributed to the much greater fat content of ducklings and geese.

Peroxide development—a chemical

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index of rancidity—was generally correlated with deterioration as measured by taste tests. But it was not as reliable as the taste tests in establishing storage life under various temperatures and other conditions.

The commercial packaging provided completely adequate moisture control. There was practically no moisture loss from the ducklings and geese, wrapped in the commonly used form-fitting plastic film.

Gypsy moth lure isolated

Gypsy moths may be controlled more effectively because of isolation and partial identification of a natural lure for the male moths, a USDA scientist reports.

More than half a million female gypsy moths were processed to obtain one drop of the attractant. It was purified by chemist M. Jacobson and coworkers at the Agricultural Research Center, Beltsville, Md. Chemical analysis of the substance, now underway, will lead to a far more readily available synthetic lure, ARS scientists believe. Analysis so far shows the substance is partly an ester alcohol, hydroxyacetoxyhexadecene.

If complete analysis shows that a synthetic attractant can be made cheaply, gypsy moth control will be improved by use of traps on a much larger scale than is now possible.

A crude form of the natural attractant is now used to lure male moths into traps in order to locate infestations and determine control requirements. The crude form is obtained by crushing segments of the females.

For many years, use of this attractant has provided the only reliable method known for determining location and extent of infestations. Its use has also provided the only way of checking effectiveness of sprays used against gypsy moths in the larval or caterpillar stage—the only times they feed.

Obtaining enough of the crude extract has become increasingly difficult, and it has been necessary at times to extract the material from gypsy moths in Europe. Under any circumstances, collection and preparation of the natural attractant are costly and time consuming.

New roof truss developed

An inexpensive new farm building roof truss—developed by ARS agricultural engineers—has balanced design and is lightweight, strong, and easily fabricated.

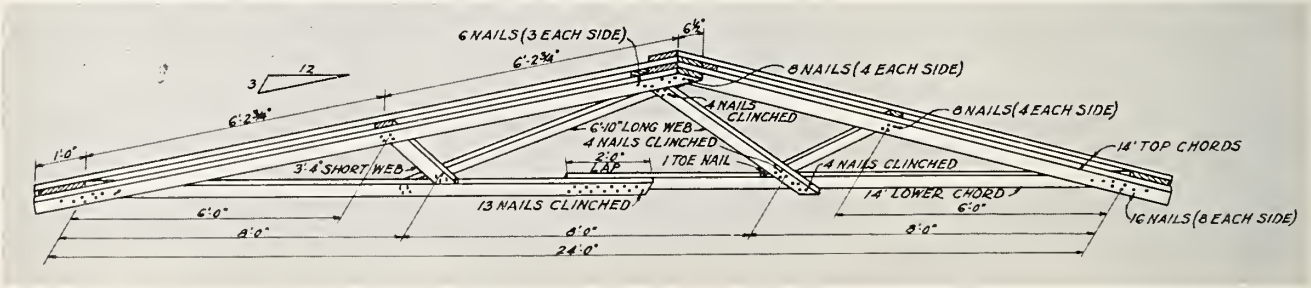
Economy is achieved through the balanced design and wood construction. Only about 70 board feet of lumber (all 2 by 4's) and about 1½ pounds of 16d nails are needed to build each truss 24 feet long.

This truss will safely support 125 pounds per lineal foot, over a span of 24 feet. Nailed joints have the strength of connected members.

A farmworker should be able to construct one truss in less than an hour, because no precision cuts are necessary. Top of the truss is wide enough to be walked on while roofing purlins are applied.

The truss was designed and tested by T. E. Kent, R. C. Liu, and N. C. Teter at USDA's Agricultural Research Center, Beltsville, Md.

Low-cost truss is easily made of structural-grade lumber. No elaborate jig is required.



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